CLAIMS

We claim:

1. A mode controlled transmission line, comprising:

a waveguide;

a structure defining at least one cavity disposed within said waveguide;

a conductive fluid, wherein said waveguide has at least a first operational state in which said at least one cavity is filled with said conductive fluid and at least a second operational state in which said at least one cavity is purged of said conductive fluid;

at least one composition processor adapted for changing at least one among an electrical characteristic and a physical characteristic of the mode controlled transmission line by manipulating a volume of said conductive fluid; and

a controller for controlling said composition processor in response to a transmission line mode control signal.

2. The mode controlled transmission line according to claim 1 wherein said transmission line has a first cutoff frequency in said first operational state and a second cutoff frequency different from said first cutoff frequency in said second operational state.

3. The mode controlled transmission line according to claim 1 wherein said waveguide has a first electrical length in said first operational state and a second electrical length different from said first electrical length in said second operational state.

4. The mode controlled transmission line according to claim 1 wherein said structure is comprised of a plurality of fluid conduits, each defining an elongated cavity, and arranged in a row to form an effective waveguide wall.

5. The mode controlled transmission line according to claim 4 wherein said plurality of fluid conduits extend from a first wall of said waveguide to an second wall of said waveguide, said second wall being spaced from said first wall.

6. The mode controlled transmission line according to claim 5 wherein said conductive fluid contained in said plurality of fluid conduits in said first state forms an electrical connection with said first and second walls.

7. The mode controlled transmission line according to claim 1 wherein said structure is a dielectric structure comprised of at least a first solid dielectric wall extending from a first conductive wall of said waveguide to a second conductive wall of said waveguide, said second conductive wall being spaced from said first conductive wall.

8. The mode controlled transmission line according to claim 7 wherein said cavity is defined between said first dielectric wall and at least one conductive wall of said transmission line.

9. The mode controlled transmission line according to claim 7 wherein said dielectric structure is further comprised of a second dielectric wall, and said cavity is defined between said first and second dielectric walls.

10. The mode controlled transmission line according to claim 1 further comprising a fluid control system for transferring said conductive fluid into and out of said at least one cavity responsive to a control signal.

11. The mode controlled transmission line according to claim 1 wherein said conductive fluid is comprised of an industrial solvent having a suspension of magnetic particles contained therein.

12. The mode controlled transmission line according to claim 11 wherein said magnetic particles are formed of a material selected from the group consisting of ferrite, metallic salts, and organo-metallic particles.

13. A method of controlling the mode of a transmission line comprising the steps of:

providing at least one waveguide filter cavity within a waveguide;

at least partially filling said waveguide filter cavity with a conductive fluid;

propagating said RF signal within said waveguide; and

changing at least a volume of said conductive fluid to selectively vary at least one of a physical dimension of the waveguide or an electrical dimension of the RF signal in response to a waveguide mode control signal.

14. The method according to claim 13 further comprising the step of constraining said conductive fluid in a portion of said waveguide to modify a cutoff frequency of said waveguide.

15. The method according to claim 13 further comprising the step of constraining said conductive fluid in a portion of said waveguide to modify an electrical length of said waveguide.

16. The method according to claim 13 further comprising the step of constraining said conductive fluid in a plurality of fluid conduits, each defining an elongated cavity, and arranged in a row to form an effective waveguide wall.

17. The method according to claim 16 further comprising the step of forming an electrical connection between said conductive fluid and at least one conductive wall of said waveguide.

18. The method according to claim 13 further comprising the step of constraining said conductive fluid using at least a first solid dielectric wall extending from a first conductive wall of said waveguide to a second conductive wall of said waveguide, said second conductive wall being spaced from said first conductive wall.

19. The method according to claim 18 further comprising the step of constraining said conductive fluid between said first dielectric wall and at least one conductive wall of said waveguide.

20. The method according to claim 19 further comprising the step of constraining said conductive fluid between said first dielectric wall and a second dielectric wall.